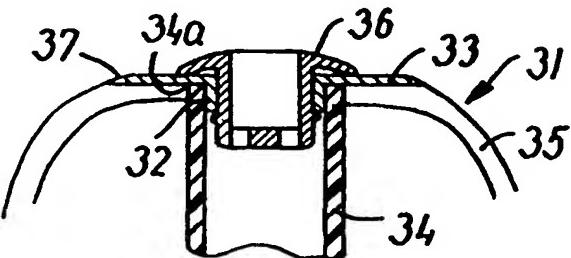


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<p>(21) International Application Number: PCT/DK99/00022            (22) International Filing Date: 15 January 1999 (15.01.99)</p> <p>(30) Priority Data:            PA 1998 00921 10 July 1998 (10.07.98) DK</p> <p>(71) Applicant (<i>for all designated States except US</i>): TØPHOLM &amp; WESTERMANN APS [DK/DK]; Ny Vestergaardsvej 25, DK-3500 Værløse (DK).</p> <p>(72) Inventors; and            (75) Inventors/Applicants (<i>for US only</i>): GUNNERSEN, Finn [DK/DK]; Degnevangen 14, DK-2750 Ballerup (DK). TØPHOLM, Jan [DK/DK]; Paradisvænget 17, DK-2840 Holte (DK).</p> <p>(74) Agents: RAFFNSØE, Knud, Rosenstand et al.; Internationale Patent-Bureau, Høje Taastrup Boulevard 23, DK-2630 Taastrup (DK).</p>		<p>(81) Designated States: AU, CA, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p><b>Published</b>  <i>With international search report.            In English translation (filed in Danish).</i></p>
<p>(54) Title: AN EAR WAX GUARD FOR AN IN-THE-EAR HEARING AID AND A MEANS FOR USE AT INSERTION AND REMOVAL HEREOF</p> <p>(57) Abstract</p> <p>For the protection of an in-the-ear hearing aid against contamination by ear wax through the acoustic outlet port (34a) or a vent, a replaceable ear wax guard (36) is inserted in the aid and comprises an essentially tubular element with a through-going cavity and an abutment collar in one end for sealing abutment against the hearing aid housing (31). For an easy and safe insertion and removal of the ear wax guard (36), an applicator is used, which in one end has a smooth pin for introduction in the through-going cavity of the ear wax guard (36) and in the other end a harpoon-shaped catch member. For mounting of the ear wax guard (36) a hose or tube member serving as acoustic outlet canal (34) is connected to an abutment collar (33) in abutment with the outside of the hearing aid. The abutment collar is designed with oversize standard dimensions and adapted to an individually user-adapted hearing aid housing by preparation of its periphery edge.</p>		



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## AN EAR WAX GUARD FOR AN IN-THE-EAR HEARING AID AND A MEANS FOR USE AT INSERTION AND REMOVAL HEREOF

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The present invention relates to a replaceable ear wax guard to be arranged in an opening of an acoustic outlet passage or in a vent in a housing designed for placement in the ear canal of an in-the-ear hearing aid.

In in-the-ear hearing aids where the hearing aid housing is placed within the user's ear canal with the acoustic outlet port facing the inner ear and connected to the telephone unit of the hearing aid, it is a well-known problem that the acoustic outlet passage is exposed to contamination with cerumen or ear wax which may lead to clogging of the acoustic outlet passage with consequently reduced sound reproduction. At worst, there may be a risk for the ear wax to enter the hearing apparatus housing and result in damage to the electrical components of the hearing aid.

In order to avoid this problem, it is known from US patent no. 4,972,488 to arrange a replaceable ear wax barrier, which can at the same time provide a dampening of the acoustic response, in the acoustic outlet passage in the apparatus housing. In this known design, the ear wax barrier is formed as a screw plug the arrangement of which presupposes a thread being provided in the acoustic outlet passage, and the ear wax barrier is in the end facing outward at the insertion by screwing, designed with incisions for providing a slot for a screw driver. The barrier effect for retaining of ear wax is obtained by providing inward projections in a through-going cavity in the screw plug.

As a consequence of the very small dimensions

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where the acoustic outlet passage has typically a diameter of about 1 mm, the screw plug form entails that insertion and removal of the ear wax guard is a rather difficult operation, especially for weak-sighted 5 hearing aid users, and the inward projections forming a kind of maze in the through-going cavity do not provide full security against migration of ear wax. Furthermore, the screw plug design cannot be used in in-the-ear hearing aids of the conventional type where 10 the acoustic outlet passage is formed by a short hose or tube member connecting the telephone unit with an acoustic output port in the wall of the hearing aid housing.

Furthermore, the international patent application 15 WO 84/04016 discloses an ear wax guard in the form of an outwardly closed plug with a disc-shaped head which at the placement of the plug covers the acoustic outlet port of the aid housing. In the plug under the disc-shaped head, there are provided radial acoustic passageways in connection with a longitudinal acoustic passageway opening in the plug end introduced in the aid housing. To secure a sufficient acoustic passage, the plug is designed such that the disc-shaped head is kept at a distance from the outside of the aid housing 20 which entails a risk, albeit reduced, of migration of ear wax under the plug and in the narrow radial acoustic passageways. As a consequence of the smooth disc-shaped head, the insertion and removal of the plug is also in this case a difficult operation.

30 In a hearing aid known from US patent no. 4,553,-627, an essentially mushroom-shaped ear wax guard with a crossing acoustic passage is mounted with snap engagement in metal ring inserted in the acoustic outlet port of the hearing aid housing.

35 On the background of this prior art, it is the

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object of the invention to provide a replaceable ear wax guard of the stated type with a simple and low-cost design suited for all kinds of in-the-ear hearing aids and which can be mounted in and removed from the aid 5 housing in a simple way.

For this purpose, the ear wax guard according to the invention is characterized in that it comprises an essentially tubular element adapted to the mouth diameter of the acoustic outlet passage or the vent and 10 having a through-going cavity which in one end is partially closed by an ear wax retaining guard whereas the element in the opposite end is connected to a surrounding abutment collar for sealing abutment against the hearing aid housing around the acoustic 15 outlet port or vent, said element being made by an elastical yielding material and said through-going cavity at its mouth in the abutment collar being adapted for introduction of a means to be used when the ear wax guard is inserted in and removed from the 20 acoustic outlet port or the vent.

As a consequence of the simple design as a short tubular element with a surrounding abutment collar in the end facing inward at the insertion, the ear wax guard according to the invention is inexpensive to 25 manufacture in a large number by moulding of the elastical yielding material, which can typically be silicone rubber or a thermoplastic elastomer. A further contribution to this is the positioning of the ear wax retaining barrier in one end of the tubular element 30 which when introduced is led into the acoustic outlet canal. The merely partial opening of this end of the tubular element can be obtained by designing the guard as a kind of screen and thus can assure a good sound transmission.

35        Advantageous features and embodiments of the ear

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wax guard are indicated in the dependent claims 2-5. In a particularly advantageous embodiment, in particular for use in connection with CIC hearing aids, the abutment collar is provided with a convex outside and 5 a concave or faintly conical underside so that its periphery edge forms a sealing lip against the aid housing. Thus, the user comfort is improved as the ear wax guard essentially follows the outer contour of the aid housing.

10 As a consequence of the sealing abutment of the abutment collar of the ear wax barrier against the hearing aid housing, the abutment collar, which can preferably be provided with a relatively thin and soft edge, fitting snugly to the surrounding outside of the 15 housing with a very even transition, it is avoided that when inserting or removing the hearing aid, the abutment collar causes any inconvenience or damage to the ear canal.

As the removal of the wax barrier in a conventional way by seizing the edge of the abutment collar 20 as known from said US publications is thus made more difficult, the invention further concerns a means to be used for insertion of an ear wax guard, characterized in that it comprises an essentially rod-shaped applica- 25 tor which in one end is provided with a smooth pin fitting the mouth of the through-going cavity of the ear wax guard for use at insertion of the ear wax guard whereas in the opposite end it is provided with a catch member for use at removal of the ear wax guard and 30 engaging the wall inner side of the through-going cavity when pressed into its mouth.

By this applicator design, the insertion of the ear wax guard in the acoustic outlet port and the removal herefrom in connection with the replacement of 35 the ear wax guard can be made in a simple way and with

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a high degree of security even by weak-sighted users, the different design of the two ends of the applicator for insertion and removal, respectively, contributing to the easy operation.

5 Advantageous embodiments of the means are indicated in the dependent claims 7-13. Thus, according to a preferred embodiment, the essentially cylindrical and wedge-shaped portion of the applicator is separated by an intermediate piece with a cross section larger than  
10 said portion, and the means comprises further a enlargement lens with a bore provided for attachment on said cylindrical or said wedge-shaped applicator portion in abutment against said intermediate piece.

Thus, a further improvement of the operating  
15 security is obtained, especially for weak-sighted hearing aid users.

As from consideration of the visibility of the through-going cavity of the ear wax guard and the risk of pressing ear wax accumulated in the ear wax guard  
20 out through the ear wax retaining barrier at insertion of the applicator in the ear wax guard in connection with the removal hereof, the catch member may not cover a too large area, the use of the applicator, especially in ITE hearing aids where the acoustic outlet canal is  
25 designed as a hose or tube member guided from the output transducer of the aid all the way through to the acoustic outlet port in the wall of the housing, will entail a certain risk that such a hose or tube member and perhaps the ear wax guard itself at the pressing-in  
30 of the catch member is pressed into the hearing aid housing.

To encounter this risk, the invention concerns in addition a particularly designed in-the-ear hearing aid for arrangement of the ear wax guard and with a housing  
35 provided for positioning in the ear canal and having an

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essentially shell-shaped wall, in which an acoustic outlet port and perhaps a vent are provided in an end part meant for placement in the ear canal, where the acoustic outlet port is in connection with one end of 5 hose or tube member serving as acoustic outlet port, the other end of which is connected to an outlet port from an outlet transducer situated in the housing.

To obtain an improved security against the hose or tube member serving as acoustic outlet canal at the 10 mounting or replacement of the ear wax guard being detached from its connection with the acoustic outlet port in the end part of the housing wall and pressed into the housing, the hearing aid according to the invention is characterized in that the hose or tube 15 member with a view to positioning an ear wax guard as stated above is connected to an annular abutment collar in abutment with the outside of said wall end part.

Appropriate embodiments for such a hearing aid are stated in the dependent claims 15-22.

20 Since the housing for in-the-ear hearing aids of the stated kind is usually designed with an individually adapted form according to the actual user's ear canal, the invention further relates to a method for manufacture of a hearing aid of the stated type which 25 permits a production of the abutment collar for mounting of the ear wax guard in a standard design independent of the individual user adaptation of the form of the housing.

According to the invention, this method is characterized in that an abutment collar is used with over-dimensioning in relation to said end part of the housing wall, and that the abutment collar by preparation of its periphery edge is formed to a flush transition with the outside of said end part.

35 The invention is further explained in the follow-

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ing with reference to the schematical drawings, where

Fig. 1 is a sectional view of a part of the housing of an in-the-ear hearing aid,

Fig. 2 a section of Fig. 1 on a larger scale,

5 Figs. 3 and 4 are perspective views of an embodiment of the ear wax guard,

Fig. 5 is a perspective view of an embodiment of an insertion and removal applicator,

Figs. 6 and 7 show on a larger scale sections of  
10 the applicator in Fig. 5,

Fig. 8 shows an embodiment of an enlargement lens mounted on the applicator in Fig. 5,

Fig. 9 shows an alternative design of the enlargement lens,

15 Fig. 10 at a)-d) illustrates insertion and removal of the ear wax guard,

Fig. 11 is a sectional view corresponding to Fig. 2, showing the end part of the housing in an embodiment of a hearing aid especially designed for positioning of  
20 the ear wax guard according to the invention,

Fig. 12 is a modification of the embodiment in Fig. 11, and

Figs. 13-17 illustrate a method for use in production of the hearing aid according to the invention.

25 Fig. 1 shows the portion 1 facing the inner ear, of the housing of an in-the-ear hearing aid designed for position in a user's ear canal. Of the internal components in the hearing aid only an outlet transducer is shown in the form of a telephone unit 2 with an  
30 output port 3 which through an acoustic outlet canal 4 formed by a hose member of plastics is connected to an acoustic outlet port 4a designed in an end wall part 5 of the housing portion 1. In order to avoid contamination of the interior of the housing portion  
35 1 with cerumen or ear wax entering through the acous-

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tic outlet canal 4, an ear wax guard 6 is placed herein.

The embodiment shown in Figs. 2-4 of the ear wax guard 6 is according to the invention designed as a short, essentially circular cylindrical tubular element 7 with a length and an outer diameter adapted to introduction into the acoustic outlet canal 4 with frictional fit.

A through-going also essentially circular cylindrical cavity 8 in the tubular element 7 is in one end, which by insertion in the acoustic outlet canal 4 is led into this, partially closed by an ear wax retaining barrier 9 which as shown in Fig. 4 may have the form of a screen with loops limited by radial threads 10.

In the opposite end the tubular element 7 is surrounded by an abutment collar 11 which in the inserted position is brought into sealing abutment against the end wall part 5 around the acoustic outlet port 4a. In the shown embodiment the abutment collar 11 has a convex outside and a concave or faintly conical underside, the peripheral edge of the collar forming a relatively thin and soft sealing lip 12 against the end wall part 5. Thus, a high degree of security is obtained against migration of ear wax under the periphery edge of the collar and the ear wax guard will in inserted position follow the contour of the aid housing which is of considerable importance as to comfort, especially at socalled CIC aid which are placed in the innermost sensitive part of the ear canal.

The ear wax guard 6 is manufactured of elastic yielding material as e.g. silicone rubber or a thermoplastic elastomer and typical with an outer diameter of 1.25-1.5 mm and an inner diameter of the

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cavity 8 of about 1 mm.

For an improved securing of the ear wax guard 6 in the acoustic outlet canal 4, the tubular element 6 can on the outside be provided with means for 5 frictional engagement, e.g. in the form of at least one circumferential bead 13.

An ear wax guard as shown and described can be placed not only in the acoustic outlet port of the hearing aid housing, but also in an opening facing the 10 inner of the ear canal, in the hearing aid housing for a vent passage, which may have the purpose of preventing or reducing socalled occlusion effects.

A means for use at insertion and removal of the ear wax guard 6 in Figs. 2-4 comprises an essentially 15 rod-shaped applicator 14 which in the embodiment shown in Figs. 5-7 in one end has an essentially circular cylindrical portion 15 and in the other end an essentially wedge-shaped portion 16 formed by bevels 17 and 18 and with a flat rectangular end edge 20 face 19. The end portions 15 and 16 are separated by an intermediate piece 20 which is connected with the end portions 15 and 16 through circular cylindrical transition portions 21 and 22, and the intermediate piece 20 has a cross-sectional dimension which is 25 larger than the adjacent transition portions 21 and 22 as is further explained in the following.

At the free end of the circular cylindrical portion 15, the applicator 14 is provided with a smooth circular cylindrical pin 23 for insertion in 30 the inner cavity 8 of the ear wax guard 6 in connection with the insertion of the ear wax guard in the acoustic outlet port 4. In the opposite end, the applicator 14 is provided with a harpoon-shaped pressing-in peak 24 projecting from the end edge 35 surface 19 which with catch edges 25 forms a catch

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member for engagement with the wall inner side of the tubular element 7 of the ear wax guard 6 around the cavity 8 in connection with removal of the ear wax guard.

5 Corresponding to the flat rectangular form of the end edge surface 19, the pressing-in peak 24 is formed as a four-sided pyramid with a flat rectangular base. The pressing-in peak 24 is dimensioned such that the long side in the base is larger than the 10 diameter of the through-going cavity 8 of the ear wax guard, the pressing depth being limited so that the pressing-in peak 24 is prevented from being pressed too far into the cavity 8 such that the ear wax accumulated in the ear wax guard 6 is not pressed 15 through the guard 9 and into the aid housing. 1.

As a consequence of the small dimensions, it is appropriate especially for weak-sighted hearing aid users, if the insertion and removal means comprises an enlargement lens designed to be positioned on the ac- 20 tually used end portion 15 or 16 of the applicator 14.

In a simple embodiment, such an enlargement lens can as shown in Fig. 8 comprise a plano-convex lens 26 in the optical axis of which there is provided a bore 25 27 suitable for arrangement of the lens on a transi- 27 tion portion 21 or 22 of the applicator 14 in engagement with the intermediate piece 20.

In order to avoid that the end portion 15 or 16 of the applicator 14 extended under the lens during 30 insertion or removal covers the wanted visual field, a bore 28 provided for the attachment of the lens on the applicator 14, as shown in Fig. 9, can in an alterna- 35 tive design be formed in a flange element 29 project- ing from the periphery of the lens and forming such an angle with the symmetry plane of the lens 30 perpen-

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dicular to the optical axis that the focus of the lens is located immediately outside the free end of the relevant end portion 15 or 16.

When inserting the ear wax guard, this is placed 5 as shown in Fig. 10a on the smooth pin 23 at the end of the end portion 15 of the applicator 14 and can thus, perhaps by using an enlargement lens as shown in Figs. 8 or 9 easily and securely be guided into the acoustic outlet port 4a and be retained with frictional fit in the acoustic outlet canal 4 formed by the hose member whereupon the applicator is removed as shown in Fig. 10b.

When a quantity of ear wax has been accumulated in the ear wax guard entailing a significant reduction of 15 the sound reproduction of the hearing aid, the ear wax guard can as shown in Fig. 10c be removed by guiding the pressing-in peak 24 of the applicator 14 into the cavity 8 of the ear wax guard until the catch edges 25 enter into engagement with the surrounding 20 wall inner side, the ear wax guard 6 being brought along at the subsequent removal of the applicator as shown in Fig. 10d.

In the embodiment shown in Fig. 11 of a particularly designed hearing aid according to the invention, 25 the ear wax guard 36 which can be designed as shown in Fig. 3 or 4 is mounted in a bushing 32 with an annular abutment collar 33 in abutment against the outside of the end wall part 35 of the housing portion 31. The bushing 32, which is preferably made 30 of a material with a larger rigidity, e.g. plastics or metal, than both the elastic hose member serving as acoustic outlet port 34 and the ear wax guard, is in this embodiment mounted internally in the hose member 34 such that this is squeezed against the edge side of 35 the acoustic outlet port 34a. The bushing 32 can

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e.g. be maintained in the end of the hose member 34 by gluing or welding of the abutment collar 33 to the end wall part 35 and/or it can be inserted with a pressure fit in the hose member 34.

5 The annular abutment collar 33 and the bushing 32 provide a cylindrical bore for mounting the ear wax guard 36 which can be effected with a means in the form of a rod-shaped applicator as described above with reference to Figs. 5-10. The abutment collar has in 10 this connection such an inner diameter that it cannot be passed by the abutment faces of the applicator around the pin 23 and the harpoon peak 24.

The periphery edge 37 of the abutment collar 33 is as shown preferably prepared such that a flush 15 transition is obtained between the abutment collar and surrounding outside of the end wall part 35.

By means of the abutment collar 33 which in the shown embodiment is in fixed connection with the hose member 34 through the bushing 32, there is obtained 20 a considerably improved security against unintentional detachment of the hose member 34 from the acoustic outlet port 34a at the mounting or replacement of the ear wax guard 36 by means of an applicator as shown in Figs. 5-10 with the risk that the hose member 34 25 is pressed completely into the hearing aid housing 31.

In the modification of this hearing aid design shown in Fig. 12, the mounting bushing 42 is with the abutment collar 43 adapted to be mounted directly in the acoustic outlet port 44a. The hose member serving 30 as acoustic outlet canal can be mounted on the outside of the bushing 42 in the same way as shown in Fig. 11, but alternatively the hose member 44 can as shown be maintained inside the mounting bushing 42. In order 35 to avoid, in this embodiment, the risk of an applicator as shown in Figs. 5-10 entering into contact with the

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hose member 44 itself, the abutment collar is preferably provided with a narrowed bore 46 for mounting of the wax guard, preferably with the same diameter as the internal diameter of the hose member 44.

5 Since the hearing aid housing for in-the-ear hearing aids is usually designed with individual adaptation to the form of the actual user's ear canal, it is in Fig. 13 illustrated how an abutment collar 53 as shown here without a mounting bushing can be  
10 obtained by using an abutment collar 53 with over-dimensions in relation to the end part 55 of the hearing aid housing 51 and preparation of the periphery edge 56 of the abutment collar 53, firstly by cutting to a suitable diameter as shown by 57 and then  
15 by grinding to obtain a flush transition against the outside of the end part 55. Also in the embodiments shown in Figs. 11 and 12, the bushings 32 and 42 with the abutment collars 33 and 43 can in a corresponding way be manufactured in a standard design with an  
20 overdimensioned abutment collar which can be adapted to the end part of the hearing aid housing by preparation in the same way.

As shown in Figs. 11-13 it is usually most appropriate, e.g. for cost reasons, that the abutment  
25 collar, whether provided with a mounting bushing or for direct connection with the hose member serving as acoustic outlet canal, is designed as a ring disc with a flat underside for abutment against the end part of the hearing aid housing. In this connection, the end  
30 part 55 of the hearing aid housing can as shown in Fig. 14 be prepared, e.g. by grinding to produce a flat abutment face 58 for the abutment collar on the mounting bushing.

Alternatively as shown in Fig. 15 such a plane  
35 abutment face 58a can be designed in a countersunk

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way by preparing the end part of the housing by milling. Whether the preparation is made by grinding or milling or in another way, the acoustic outlet port 54a in the end part of the housing 55 is used as a 5 guide for a preparation tool designed for this purpose.

As shown in Fig. 16, at the ready-mounting of a hearing aid in the design according to the invention, a hose element 64 can be used with a surplus length which is guided through the acoustic outlet port 64a 10 in the end part 65 of the housing 61 and fastened hereto by gluing or welding, whereupon the projecting part of the hose member 64 is cut flush with the abutment face 68 formed by preparation of the end part 65 as explained above. By this mounting way, the 15 hearing aid design according to the invention can as shown be provided either in the way that an abutment collar 63 without any mounting bushing is, as shown in Fig. 13, connected directly with the abutment face 68 by gluing or welding, or by insertion of a mounting 20 bushing 32 with an abutment collar 33 with a design as shown e.g. in Fig. 11 in the end of the hose element 64.

The ready-mounted hearing aid housing 61 with the abutment collar 33 or 53 in abutment against the 25 outside of the end part 65 of the hearing aid housing 61 is shown in Fig. 17.

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## P A T E N T C L A I M S

1. Replaceable ear wax guard for placement in an opening (4a, 34a, 44a) for an acoustic outlet canal (4, 34, 44) or a vent in a housing (1, 31, 41) of an in-the-ear hearing aid designed for positioning in the ear canal characterized in that it comprises an essentially tubular element (7) adapted to the mouth diameter of the acoustic outlet canal (4, 34, 44) or the vent and having a through-going cavity (8) which in one end is partially closed by an ear wax retaining barrier (9), whereas the element (7) in the opposite end is connected with a surrounding abutment collar (11) for sealed abutment against the hearing aid housing around the acoustic outlet port or the vent (4a), said element (7) being made by an elastic yielding material, and said through-going cavity (8) at its mouth in the abutment collar (11) being designed for insertion of a means (14) to be used by the insertion or removal of the ear wax guard (6) from the acoustic outlet opening or the vent (4, 34, 44).

2. An ear wax guard according to claim 1, characterized in that the tubular element (7) is essentially circular cylindrical and is provided on the outside with means (13) for frictional engagement with the wall of the acoustic outlet opening or vent (4).

3. An ear wax guard according to claim 2, characterized in that said means comprise at least one circumferential bead (13).

4. An ear wax guard according to claim 1, 2, and 30 3, characterized in that the through-going cavity (8) is essentially circular cylindrical with a smooth wall inner side.

5. An ear wax guard according to any of the preceding claims, characterized in that 35 the abutment collar (11) is provided with a convex

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outside and a concave or faintly conical underside such that its peripheral edge (12) forms a sealing lip against the aid housing.

6. A means to be used for insertion of an ear wax guard (6) according to any of the preceding claims in an opening (4a) for the acoustic outlet canal (4) and/or a vent in the housing (1) of an in-the-ear hearing aid designed for positioning in the ear canal and for removal of the ear wax guard (6) from said opening, characterized in that it comprises an essentially rod-shaped applicator (14) which in one end is provided with a smooth pin (23) fitting the mouth of the through-going cavity (8) of the ear wax guard for use at insertion of the ear wax guard (6) whereas in the opposite end it is provided with a catch member (24) for use at removal of the ear wax guard (6) and engaging the wall inner side of the through-going cavity (8) when pressed into its mouth.

7. A means according to claim 6, characterized in that the applicator (14) is provided in said opposite end with an abutment (19) for limitation of the pressing-in depth of said catch member (24) in the through-going cavity (8) in the ear wax guard (6).

8. A means according to claim 7, characterized in that the applicator (14) comprises at said one end an essentially cylindrical portion (15) and at said opposite end an essentially wedge-shaped portion (16) with an end edge surface (19) which for formation of said abutment has a length exceeding the diameter of the through-going cavity (8) of the ear wax guard (6).

9. A means according to claim 8, characterized in that said catch member comprises a harpoon-shaped pressing-in peak (24) projecting from said end edge surface (19) and having catch edges (25)

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for providing said engagement with the ear wax guard  
(6) within the mouth of the through-going cavity (8).

10. A means according to claim 9, characterized in that the pressing-in peak (24) has the  
5 form of a pyramid with a small rectangular base.

11. A means according to claim 8, 9, or 10, characterized in that the essentially cylindrical and wedge-shaped portions (15, 16) of the applicator (14) are separated by an intermediate piece (20)  
10 with a larger cross section than said portions, and that the means further comprises an enlargement lens  
(26, 30) with a bore (27, 28) provided for attachment  
on said cylindrical or said wedge-shaped applicator  
portions (15, 16) in abutment against said intermediate  
15 piece (20).

12. A means according to claim 11, characterized in that said bore (27) is provided in  
the optical axis of the enlargement lens (26).

13. A means according to claim 11, characterized in that said bore (28) is provided in a  
20 flange element (29) connected to the enlargement lens  
(30), and that the symmetry plane of the enlargement  
lens (30) perpendicular to the optical axis is inclined  
with respect to said flange element (29) such that the  
25 focus of the enlargement lens (30) by attachment on  
the applicator (14) is positioned immediately outside  
said one or said opposite end.

14. An in-the-ear hearing aid with a housing (1,  
31, 41, 51, 61) provided for positioning in the ear  
30 canal and having an essentially shell-shaped wall, in  
which in an end part (5, 35, 45, 55, 65) meant for  
placement inside the ear canal, there is provided an  
acoustic outlet port (4a, 34a, 44a, 54a, 64a) and  
optionally a vent where the acoustic outlet port (4a,  
35 34a, 44a, 54a, 64a) is in connection with one end of a

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hose or tube member serving as acoustic outlet canal (4, 34, 44), the other end of which is retained in an outlet port (3) from an output transducer (2) arranged in the housing (1), characterized in that 5 the hose or tube member (34, 44, 54, 64) with a view to positioning of an ear wax guard according to any of the claims 1-5 is connected to an annular abutment collar (33, 43, 53) in abutment with the outside of said wall end part (35, 45, 55, 65).

10 15. A hearing aid according to claim 14, characterized in that the abutment collar (33, 43) is formed by a bushing inserted in the acoustic outlet port or the vent (34a, 44a).

16. A hearing aid according to claim 15, characterized in that the bushing (32, 42) is of 15 a material with a larger rigidity than the hose or tube member (34, 44, 64) and than the ear wax guard (36).

17. A hearing aid according to claim 15 or 16, characterized in that the bushing (32) is 20 designed for arrangement inside the hose or tube member (34, 64).

18. A hearing aid according to claim 17, characterized in that the hose or tube member (34) is designed for placement in abutment against the 25 edge side of the acoustic outlet port (34a) to be pressed in between the bushing (32) and said edge side.

19. A hearing aid according to claim 15 or 16, characterized in that the bushing (42) is 30 designed for arrangement inside the hose or tube member (44).

20. A hearing aid according to claim 19, characterized in that the abutment collar (43) on the bushing (42) is provided with a reduced diameter adapted to the inside diameter of the hose or tube 35 member (44).

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21. A hearing aid according to any of the claims  
14-20, characterized in that the abutment  
collar (33, 43, 53) is formed as a ring disc with a  
flat underside for abutment against said end part of  
5 the wall of the housing.

22. A hearing aid according to claim 21, char-  
acterized in that the abutment collar (53)  
is fastened directly to said hose or tube member (54,  
64).

10 23. A hearing aid according to any of the claims  
14-21, characterized in that the abutment  
collar has such a diameter that it cannot be passed by  
a means as stated in any of claims 6-13 at mounting and  
replacement of an ear wax guard as stated in any of  
15 claims 1-5.

24. A method for use in production of a hearing  
aid according to any of the claims 14-23, charac-  
terized in that an abutment collar (53) is used  
with over-dimensioning in relation to said end part  
20 (55) of the housing wall (51), and that the abutment  
collar (53) by preparation of its periphery edge is  
formed to a flush transition with the outside of said  
end part (55).

25. A method according to claim 24 for use in  
25 production of a hearing aid according to claim 21,  
characterized in that said end part (55)  
of the housing wall is formed by providing a flat  
abutment face (58) for the abutment collar (53).

26. A method according claim 25, charac-  
30 terized in that said end part is prepared by  
countersinking of said abutment face (58a).

27. A method according claim 25 or 26, by which in  
the ready-mounted hearing aid, a hose or tube member  
with a surplus length is used as acoustic outlet canal  
35 (64) and guided through the acoustic outlet port (64a)

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c h a r a c t e r i z e d in that the projecting length of the hose or tube member (64) is cut flush with the formed abutment face (58, 58a), and that an abutment collar (63) is placed directly against said 5 abutment face (68) and the cut end of the hose or tube member (64) flush with said face.

28. A method according claim 27, c h a r a c - t e r i z e d in that an abutment collar in the form of a flat ring disc (53) is used as direct connection with 10 said abutment face (68).

29. A method according claim 27, c h a r a c - t e r i z e d in that an abutment collar (33, 43) is used which is formed by one end of a tubular mounting bushing (32, 42) introduced with press fit in said hose 15 or tube member (34, 44).

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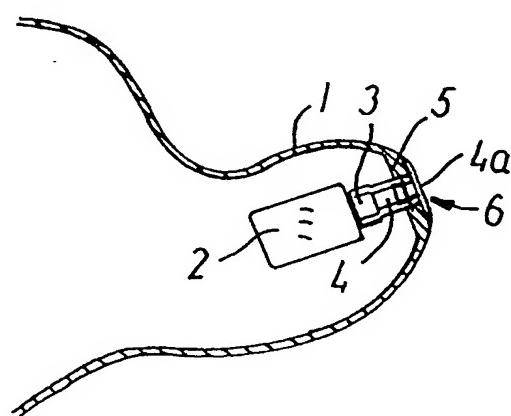


FIG. 1

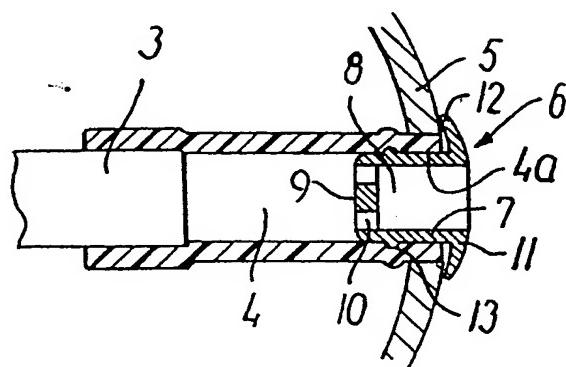


FIG. 2

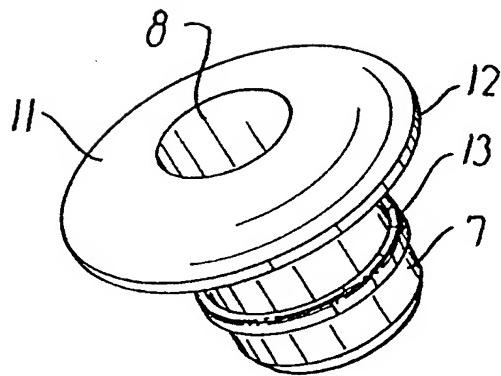


FIG. 3

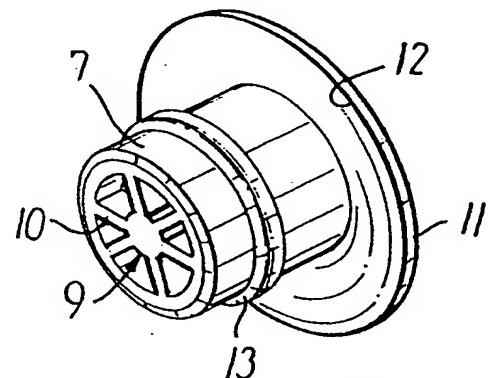
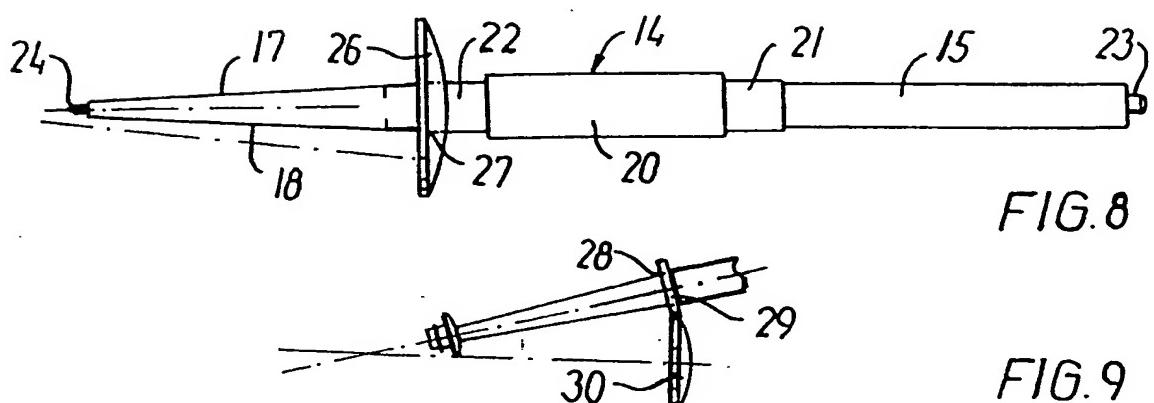
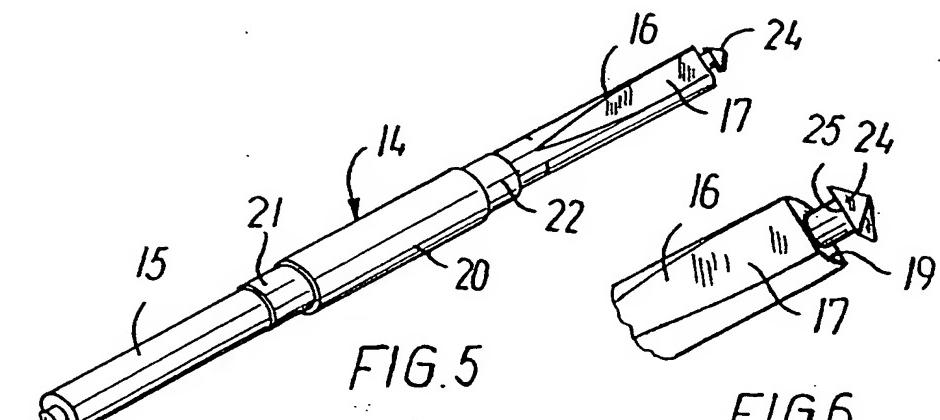


FIG. 4

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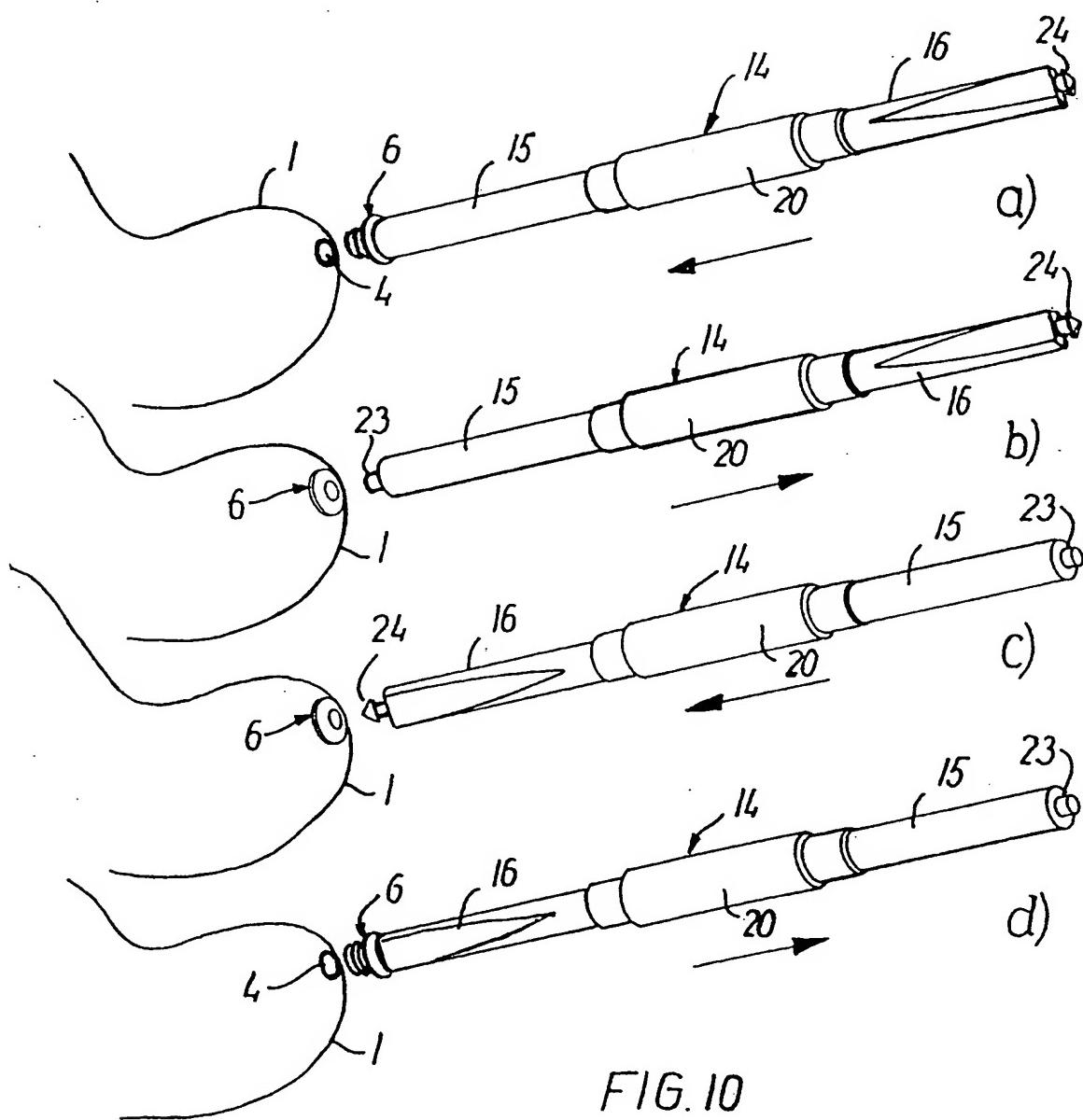


FIG. 10

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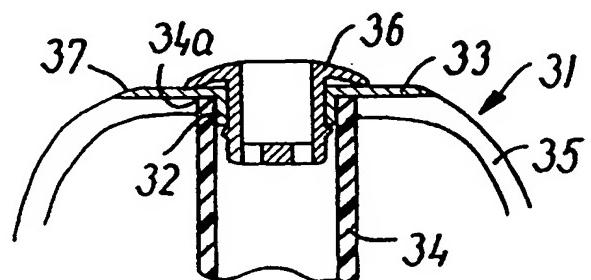


FIG. 11

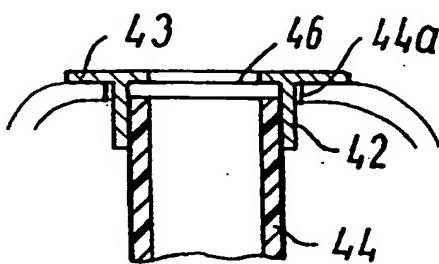


FIG. 12

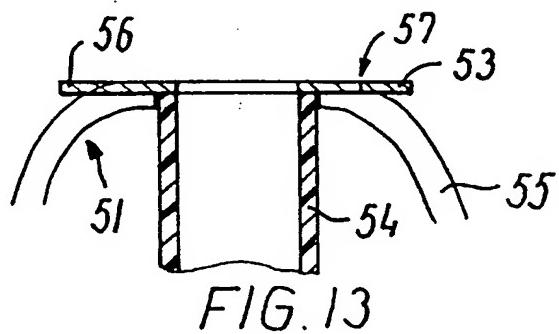


FIG. 13

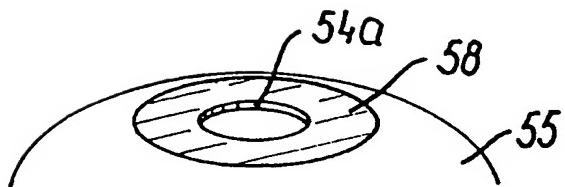


FIG. 14

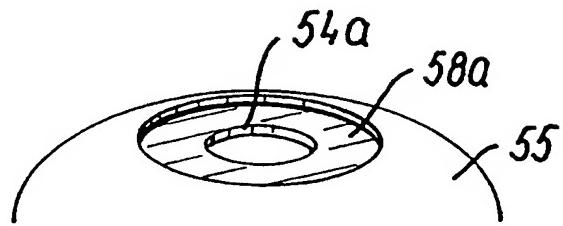


FIG. 15

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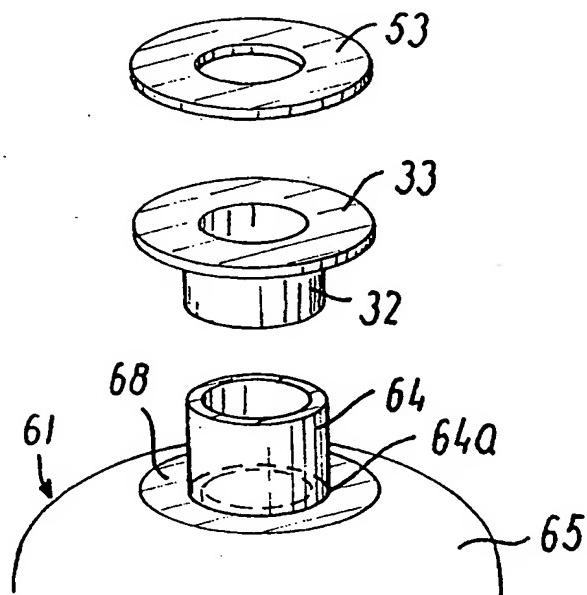


FIG. 16

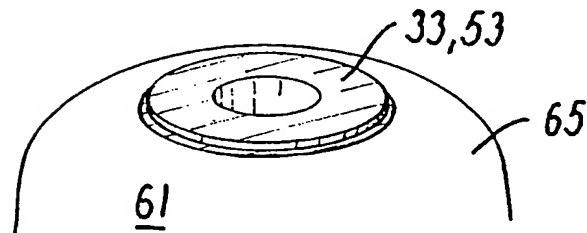


FIG. 17

## INTERNATIONAL SEARCH REPORT

Internat. Application No  
PCT/DK 99/00022

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04R25/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 H04R B25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 724 377 A (BELTONE ELECTRONICS) 31 July 1996	1-3, 14
A	see column 1, line 5-8 see column 2, line 21 - column 3, line 3 see column 4, line 14-26 see column 4, line 34 - column 5, line 14 see column 5, line 51 - column 7, line 20 see column 7, line 45 - column 8, line 21 ---	4, 15-29
Y	DE 36 03 704 A (ROBERT BOSCH GMBH) 13 August 1987	1-3, 14
A	see figure 1 see column 2, line 52-57 ---	5, 15-29
		-/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

31 May 1999

08/06/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
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Zanti, P

**INTERNATIONAL SEARCH REPORT**

Internat.	Application No
PCT/DK 99/00022	

**C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 42 32 317 A (UNITRON INDUSTRIES) 13 May 1993 see column 2, line 20 - column 4, line 56	1,14
A	---	2-4, 6-10, 15-29
A	DE 36 16 637 A (SIEMENS) 19 November 1987 see column 2, line 31 - column 3, line 51	1,6-13
A	FR 2 347 158 A (F.GUNNERSEN) 4 November 1977 see page 1, line 7-13 see page 1, line 26 - page 3, line 1	1,6, 11-13

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

Internat.	Application No
PCT/DK 99/00022	

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP 724377 A	31-07-1996	US	5712918 A	27-01-1998
		CA	2165389 A	28-07-1996
		JP	8265898 A	11-10-1996
		US	5864628 A	26-01-1999
DE 3603704 A	13-08-1987	NONE		
DE 4232317 A	13-05-1993	CA	2052423 A	27-03-1993
		US	5278360 A	11-01-1994
DE 3616637 A	19-11-1987	DE	8613394 U	16-02-1989
		US	4840249 A	20-06-1989
FR 2347158 A	04-11-1977	DK	74376 A	24-08-1977
		DE	7704943 U	02-06-1977